

Application No. 10/669,616
Amendment dated May 9, 2006
Reply to Office Action of December 9, 2005

Remarks/Arguments

Claims 1-3, 6-7, 10-14, 17, 19-22, and 24-30 are in the application. Claims 4-5, 8-9, 15-16, 18, and 23 are cancelled. Claims 25-30 are added by this amendment. Claims 1, 6, 14, and 24 are in independent form.

Claim Rejections 35 USC § 102

Claims 12 and 13 stand rejected under 35 USC 102(e) as being anticipated by US2003/0138709 A1 to Burbank et al. ("Burbank"). Applicant has amended claims 12 and 13 to make them dependant on amended claim 6. Applicant submits that the reference cited by the Examiner does not set forth, either expressly or inherently, all of the elements of the amended claims.

Claim Rejections 35 USC § 103

All of Applicant's pending claims stand rejected for obviousness over a combination of Burbank, U.S. Pat. No. 6,440,615 B1 to Shimizu ("Shimizu"), and US 2001/0027917 A1 to Ferranti et al. ("Ferranti").

1. Non-liquid metal or argon gas ion source

Amended claim 1 (along with dependent claims 2-3) and claim 24 (along with dependent claims 25-29) contain the limitation that the focused ion beam has a non-liquid metal ion source. Amended claim 6 (along with dependent claims 7, 10-13, and 30) and amended claim 14 (along with dependent claims 17 and 19-23) contain the limitation of an ion beam of noble gas ions.

First, the Examiner states that since Burbank does not disclose the material of the ion beam, "Burbank could utilize any conventional ion beam known in the art of focused ion beam

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sputter etching." This is a complete misstatement of the law and of the MPEP. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987); See M.P.E.P. § 2131. Because Burbank does not disclose the material of the ion beam, the claim is only anticipated by the Burbank reference if the element is inherent in the reference. *Verdegaal Bros.*, 814 F.2d at 631, 2 USPQ2d at 1053; M.P.E.P. § 2131. However, a claim limitation is inherent in the prior art only if it is necessarily present in the prior art, not merely probably or possibly present. *Rosco v. Mirror Lite*, 304 F.3d 1373, 1380, 64 USPQ2d 1676 (Fed. Cir. 2002) (emphasis added). This claim limitation is certainly not necessarily present since Burbank could have (and, as Applicant understands it, did) use a gallium ion beam.¹

Further, although Shimizu did teach the use of an argon beam, a *prima facie* case of obviousness has still not been established because a skilled person would have had no motivation to combine the references. It is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. *Ex parte Haymond*, 41 USPQ2d 1217, 1219 (Bd. Pat. App. & Inter. 1996); *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). It is impermissible to use the claimed invention as an instruction manual or "template" to piece together isolated disclosures and teachings of the prior art so that the claimed invention may be rendered obvious.

¹ In fact, Applicant's invention was developed after discussions with Burbank and the assignee of the Burbank invention because, as Applicant understands it, the Burbank invention was not fast enough for production use. It is also Applicant's understanding that Burbank was using a gallium beam. Although Applicant can supply an affidavit showing that Burbank was using a gallium beam if it becomes dispositive, it is certainly clear that a gallium beam could have been used.

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Here, the only rationale offered by the Examiner in support of the combination of the references is that the argon ion beam (taught by Shimizu) was "conventional in the art of focused ion beam sputter etching." However, the fact that an element is known in the art does not provide a motivation to combine. There is nothing in either of these references that provides any sort of "teaching, suggestion or incentive supporting the combination."

The Examiner also states (in rejecting claim 17) that it would have been obvious to combine the argon ion beam in Shimizu with Burbank because "gallium and argon beams are art recognized equivalents." While Shimizu does suggest that argon ions can be used for material removal, the reference goes on to teach that "[t]he larger an ion's atomic number is, the higher the sputtering rate therefore becomes." Shimizu, col. 8, lines 31-33. Since gallium has an atomic number that is higher than argon, Shimizu actually teaches away from using an argon ion beam for rapid material removal. The Examiner provides absolutely no rationale adequately supporting a motivation to combine the references.

Further, to the extent that the Examiner is arguing that it would have been obvious to try an argon beam, that argument also fails to satisfy the legal requirement of obviousness. The very reference relied upon by the Examiner teaches that milling with an argon beam would be slower than milling with a gallium beam. Nothing in any of the cited references suggests that any advantage would be gained by using an argon beam. Thus no skilled person would have understood from the cited references that the use of a different ion beam (in this case argon) would be a result-effective variable contributing a positive result. *See In re Antonie*, 559 F.2d 618, 620, 195 USPQ 6, 8 (CCPA 1977) (finding no obviousness where parameter optimized was not recognized to be a result-effective variable). Based upon the teaching of Shimizu, there would have been no reasonable expectation that using an argon beam would be successful. No

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rational person of skill would be motivated to combine Shimizu with Burbank in attempt to increase milling speed

2. Beam current limitations

Rejected claims 1 (along with dependent claims 2 and 3), 10-13, 20-21, and 24 (along with dependent claims 25-29) also require a beam current greater than 300 nanoamps.

Although none of the references teaches or suggests a beam current greater than 300 nanoamps, the Examiner argues that Ferranti teaches an ion beam source with an energy of 1-60 KeV and therefore "utilizing a beam current within Applicant's range would be obvious using Ferranti's power requirements given that a focused ion beam could be used for etching." As discussed above, a limitation is only inherent if it is necessarily present in the prior art, not merely probably or possibly present. This limitation is simply not inherent in Ferranti because it is certainly possible to have a beam current that is greater than 300 nanoamps with a 1 to 60 keV ion beam, even if the beam is used for milling. A Gallium LMIS ion column, such as the column used in Ferranti) normally allows a maximum beam current of around 20 nanoamps (although higher beam currents can be used, the resulting ion beam will be of very poor quality). In order to sustain this objection, the Examiner must provide some explanation as to why it would have been obvious to use a beam current of greater than 300 nanoamps.

Further, claims 1-3 and 24 are limited to non-liquid metal ion sources. Since Ferranti utilized a gallium ion source, no skilled person would have had any motivation to apply beam source energies from Ferranti because Applicant's invention is limited to a completely different type of ion source. The Examiner is simply using the claimed invention as an instruction manual or "template" to piece together isolated disclosures and teachings of the prior art so that the claimed invention may be rendered obvious. It is well established that this approach is contrary to the law.

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3. *Beam angle*

Rejected claims 1 (along with dependent claims 2 and 3), and 14 (along with dependent claims 17 and 19-23) all contain the limitation that the ion beam is directed at an oblique angle relative to the surface of the substrate. Claims 3, 6 (along with dependent claims 7, 10-13, and 30) and 19 all contain the limitation that the beam is directed at the surface of the substrate at an angle greater than 80 ° (or from 40° to 80°). Claim 24 ((along with dependent claims 25-29) contains the limitation that the optical axis of the ion source form an oblique angle relative to the substrate surface normal.

None of the references cited by the Examiner teach these limitations. Neither Burbank nor Shimizu mentions anything about the ion beam incidence angle. Although in the apparatus taught by Ferranti, there will be some minute changes in beam incidence angle resulting from deflection of the ion beam, those changes would be so small that the beam incidence angle would still be effectively normal (i.e. 90 degrees). No skilled person would understand Ferranti to teach an ion beam "directed at an oblique angle relative to the surface of the substrate."

FIG. 1 from Ferranti, relied upon by the Examiner, is not to scale and is not intended to teach substantially oblique beam angles, certainly nothing approaching the 40 to 80 degree angles claimed by Applicant's claims 3, 6 (along with dependent claims 7, 10-13, and 30) and 19.² Notably, nothing in the Ferranti specification mentions anything about an oblique beam angle. No skilled person would understand Ferranti's FIG. 1 to teach the limitations found in Applicant's claims, especially since the apparatus described in Ferranti would not be capable of producing such extreme beam incidence angles in normal use.

² The Ferranti drawing was prepared by the same law office prosecuting the instant Application.

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Further, Applicant's claim 1 has been amended to better explain Applicant's invention. Amended claim 1 (and dependent claims 2-3) contains the limitation that the sputtering beam "maintain[s] an substantially identical oblique angle relative to the surface of the substrate while material is removed by ion beam sputtering." Even if Ferranti is interpreted to teach an oblique beam incidence angle, that angle would not stay substantially constant. Rather, the angle would be largest when the beam was impacting the edges of the field of view and would return to normal at the center of the field of view.

Significantly, using the arguable "oblique beam angles" allegedly taught by Ferranti would render Applicant's invention virtually unusable. As pointed out in Applicant's Specification, sputter rate is affected by beam angle. Using a beam angle which varied between 40 to 80 degrees and normal over the field of view would result in part of the target mark being recovered long before other parts of the target mark. Completely uncovering the target mark would likely result in damage to certain parts of the mark, potentially rendering the mark unusable. Even if a skilled person would have given Examiner's extreme interpretation to the teachings of Ferranti, there would have been no motivation to use the Ferranti design since it would have been unsuitable for the purposes of Applicant's invention.

Finally, Applicant's claim 24 (and new claims 25-29) contains the limitation that the optical axis of the beam column forms "an oblique angle relative to the substrate surface normal." Ferranti teaches nothing of the kind. As clearly seen in Fig. 1, the optical axis of ion beam column (16) is not oblique relative to the substrate surface normal.

Any Remaining Claims

Applicant submits that the remaining claims, being dependent from claims that are allowable for reasons stated above, are also allowable. Accordingly, Applicant requests that the objections to these remaining claims also be withdrawn.

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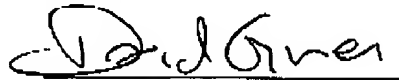
New Claims

Applicant adds claims 25-30 in order to more completely claim the invention. Claims 25 and 26 are supported for example, in paragraph [1034] of the specification. Claim 27 is supported for example, in paragraph [1002] of the specification. Claim 28 is supported for example, in paragraphs [1008] and [1011] of the specification. And Claims 29 and 30 are supported for example, in paragraph [1033] of the specification.

Conclusion

Applicant submits that all claims in the application are now in condition for allowance, and Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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